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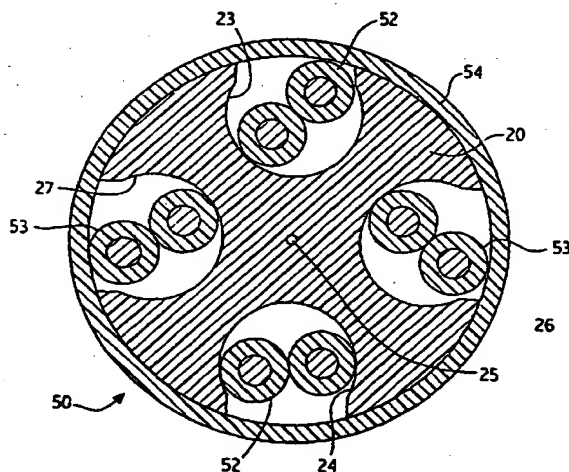
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09/453,745 2 December 1999 (02.12.1999) **US**
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(54) Title: **A CABLE CHANNEL FILLER AND CABLE CONTAINING THE SAME**



(57) Abstract: A cable channel filler (20) and a cable (50) containing the cable channel filler (20) in its core. The channel filler (20) extends longitudinally and has a plurality of spaced longitudinally extending open pockets (23-24 & 26-27) in which cables, such as twisted pair cables (52 & 53), can be placed as part of the core. The core containing the twisted pair cables (23-24 & 26-27) in the pockets (52 & 53) can be jacketed, shielded and jacketed, or any other desired cable construction that would benefit from the use of our elongated channel filler (20). The longitudinal pocket channel openings (31) have a width (32) that is less than the envelope diameter (44) of the cable (50) to be placed in the pocket and is preferably equal to the envelope diameter (44) of the cable (23-24 & 26-27) to be placed in the pocket and is preferably equal to the envelope diameter (44) minus the maximum allowable compression distance of the cable in the pocket. Also, the cross sectional area of the pocket is substantially equal to or greater than the envelope cross sectional area of the twisted pair cable (23-24 & 26-27) and the depth (33) of the pocket is equal to or greater than the envelope diameter (44).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A CABLE CHANNEL FILLER AND CABLE CONTAINING THE SAME***FIELD of the INVENTION***

The present invention relates to a cable channel filler and a cable having the channel filler. More particularly the present invention relates to a channel filler having a plurality of cable holding pockets with each pocket having an channel opening having a channel width that is less than the diameter of the envelope area of a cable or a twisted pair cable that to be placed in each pocket. The cable that has our channel filler has a core that includes our channel filler which has a plurality of cables in its pockets and which are separated a predetermined distance from each other in the channel filler.

BACKGROUND of the INVENTION

The most popular fillers are generally based on a circular cross-section wherein each pocket generally has a cross-sectional area that is greater than the cross-sectional envelope area of the twisted pair cable that is to be placed in the pocket, and a pocket channel opening width that is equal to or greater than the diameter of the envelope area of the cable(s) in the pocket.

SUMMARY of the INVENTION

Our channel filler has a plurality of longitudinally extending segmented tubular pockets each with a longitudinally extending channel opening. The width of the channel opening for each of the pockets is less than a cable envelope diameter of

the cable to be held in the pocket. The channel filler pockets allow holding the cables in the pockets in a fixed relationship to each other. This provides good dimension stability for each cable(s) within the channel filler.

For instance, with the preferred construction of our channel filler, each segmented tubular pocket is sized to the cable it is to carry. Thus, the diameter of the pocket is substantially equal to the diameter of the cable envelope that is in the pocket and the width of the channel opening is equal to the cable envelope diameter minus the maximum allowable cable compression distance. This construction holds the cable in the pocket in place and generally provides dimensional stability between the various cables in the pockets. Also, the pockets can be spaced in such a way to provide appropriate spacing between signal carrying cables to provide good signal characteristics such as impedance, crosstalk, capacitance, etc.

A communication cable manufactured using the channel filler of our invention generally has a cable such as a twisted pair cable in each pocket. Then the cable containing channel filler is shielded and jacketed, just jacketed or any other desired cable construction that would benefit from the use of our elongated channel filler.

Therefore, it is an object of the present invention to provide a cable channel filler having a longitudinally extending channel filler body having a plurality of spaced longitudinally extending open pockets, with the pockets being sized to hold a cable therein having a cable envelope diameter, and each of the

pockets having a channel opening extending from the pocket and the channel opening having an opening width less than the envelope diameter.

It is still another object of the present invention to provide a cable channel

filler having a longitudinally extending channel filler having a four spaced,

5 parallel longitudinally extending open pockets for separating four twisted pair

cables, a cross-section of the channel filler having a first axis and a second

axis, the first axis being substantially perpendicular to the second axis,

a first pair of pockets being diametrically spaced from each other and being on

the first axis, a second pair of pockets being diametrically spaced from each

10 other and being on the second axis, each of the first pair of pockets having

substantially the same cross-sectional area, each of the second pair of pockets

having substantially the same cross-sectional area, the first pockets having a

depth greater than a depth equal to or greater than a first cable envelope

diameter of a first twisted pair cable to be place in the first pockets, and a

15 pocket diameter about equal to the first cable envelope diameter,

the width of the first pocket opening being substantially equal to the first cable

envelope diameter minus a maximum allowable compression distance of the

first twisted pair cable, the second pockets having a depth greater than a depth

equal to or greater than a second cable envelope diameter of a second twisted

20 pair cable to be place in second pockets, and a pocket diameter equal to about

the second cable envelope diameter; and the width of the second pocket

opening being substantially equal to the second cable envelope diameter minus

a maximum allowable compression distance of the second twisted pair cable.

It is still a further object of the present invention to provide a communication cable having a cable core surrounded by a jacket, the cable core having a longitudinally extending channel filler having four parallel spaced, longitudinally extending open pockets for separating four twisted pair cables,

5 a cross-section of the channel filler having a first axis and a second axis, the first axis being substantially perpendicular to the second axis, a first pair of pockets being diametrically spaced from each other and being on the first axis, a first twisted pair cable being in each of the first pair of pockets,

10 a second pair of pockets being diametrically spaced from each other and being on the second axis, a second twisted pair cable being in each of the second pair of pockets. each of the first pair of pockets having substantially the same cross-sectional area, each of the second pair of pockets having substantially the same cross-sectional area, each of the first pair of pockets having a depth greater than a depth equal to or greater than a first cable envelope diameter and

15 a pocket diameter about equal to said first cable envelope diameter, the width of said first pocket opening being substantially equal to the first cable envelope diameter minus a maximum allowable compression distance of said first twisted pair cable, each of the first pair of pockets having a depth greater than a depth equal to or greater than a first cable envelope diameter of

20 the first twisted pair cable and a pocket diameter about equal to the first cable envelope diameter, and the width of the first pocket opening being substantially equal to the first cable envelope diameter minus a maximum allowable compression distance of the first twisted pair cable.

The present invention and the advantages thereof will become more apparent upon consideration of the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

5 FIG. 1 is an enlarged perspective view of the elongated channel filler of our invention.

FIG. 2 is a cross-sectional view taken along lines 2-2 of FIG. 1.

FIG. 3 is an enlarged partial cross-sectional plan view of FIG. 1.

10 FIG. 4 is an enlarged cross-sectional view of a twisted pair cable to be used with the channel filler of FIG. 1.

FIG. 5 is perspective view of a cable utilizing our elongated channel filler.

FIG. 6 is an enlarged cross-sectional view taken along lines 6-6 of FIG. 5.

FIG. 7 is a perspective view of another cable utilizing our elongated channel filler.

15 FIG. 8 is a perspective view of still another cable utilizing our elongated channel filler.

FIG. 9 is an enlarged cross-sectional view of a further cable utilizing our elongated channel filler.

FIG 10 is an enlarged cross-sectional view of an alternative channel filler in accordance with our invention.

5 FIG. 11 and 12 are illustrative views of the axis of a pocket twisted about the axis of our channel filler.

DETAILED DESCRIPTION

The following description taken in conjunction with the drawings will further explain the inventive features of our elongated channel filler and cables

10 utilizing our elongated channel filler.

Referring to FIGS. 1-3, our elongated channel filler 20 has along its cross-sectional plane a first axis 21 and a second axis 22. In the embodiment shown, the channel filler has four pockets 23, 24, 26, and 27. The first axis 21 is perpendicular to the second axis 22. The pockets 23 and 24 are centered on

15 the first axis 21 and pockets 26 and 27 are centered on the second axis 22.

The pockets 23 and 24 have the same cross-sectional area as each other and pockets 26 and 27 have the same cross-sectional area as each other. If desired, they can all have the same or different cross-sectional area depending on the cables that are to be placed in the pockets. This is also of the case concerning
20 the pockets. There can be two or more pockets and more than four pockets.

The spacing between the pockets will depend on what cables are to be placed in the pockets.

Referring to Fig. 3, there is shown an enlarged portion of the channel filler 20 to illustrate the similar characteristic's of all of the pockets. Each of the
5 pockets is a segmented tube having a diameter 28. The circular wall portion 29 of each pocket extends for greater than 180° . A spaced pair of longitudinally extending walls 30, extend from the segmented portion of the tube to provide a longitudinally extending rectangular channel opening 31. The width 32, of the channel opening 31, of each pocket is less than the diameter
10 of the cable envelope in the pocket and equal to or greater than the envelope diameter (i.e., 44, Fig. 4) minus the maximum allowable compression distance of the cable to be placed in the pocket.

Each of the pockets has a depth 33, which extends from the filler envelope 34, to the base of the pocket. The depth 33 is equal to or greater than the diameter
15 of the cable envelope to be placed in the pocket.

The cross-sectional area of each of the pockets 23, 24, 26 and 27 is shown as being greater than the cross-sectional area of the twisted pair cable envelope 43 (Fig. 4). The cross-section area of the pocket shown in Fig. 3 is defined by walls 29, 30 and the envelope 34. The cross-section area of each pocket
20 can be as small as the cross-sectional area of the envelope of the cable to be placed therein.

The preferred material for the elongated channel filler is any suitable polymer or copolymer depending on the needs of the user for crush resistance, breaking strength, gel fillings, safety, and the need for flame and smoke resistance. In many applications the material will be a polyethylene.

5 FIG. 4 illustrates a cross-section of a twisted pair cable 40 having a pair of conductors 41, with appropriate insulation 42. The cable 40 has a circular envelope 43. The diameter 44 of the circular envelope 43 is approximately equal to the diameter of its respective pocket.

The conductors 41, for the twisted pair cables are generally copper, tinned copper, or any other appropriate conductor. The conductor insulation is
10 a foamed or non-foamed insulation of polyethylene, polypropylene, fluorinated ethylene propylene, tetrafluoroethylene, polyvinyl chloride, etc.

The twisted pairs can be individually shielded if desired and in some cases, some or all of the pockets can be used to hold bundles of fiber-optic cables
15 along with other types of cables.

Referring to FIGS. 5 and 6, there is shown a cable 50, having as its core our elongated channel filler 20 with first pair of diametrically opposed pockets 23 and 24 each containing a twisted pair cable 52, having a long lay of about 0.5 in. to about 1.5 in. and with second pair of pockets 26 and 27, each containing

a twisted pair cable 53, having a short lay of about 0.25 in. to about 0.75 in.

The twisted pair cables 52 and 53 are the same construction as the twisted pair cable 40. The core which contains the elongated channel filler 20, and the cables 52 and 53, in the pockets as shown in FIGS. 5 and 6, is surrounded by a jacket 54 which was extruded thereover. The jacket 54 can be any suitable jacket material normally utilized such as foamed or non-foamed polyvinyl chloride, fluorinated polymers, polyethylene, the flame retardant compositions, etc.

Generally for a communication cable having four twisted pair cables, all of the same size with or without different lays, it can use our channel filler having a diameter of about 0.150 inches to about 0.350 inches and channel pockets having a diameter of about 0.050 inches to about 0.120 inches. The size of the twisted pair cables are generally about 24 AWG. to about 22 AWG. For other applications, the channel filler will have as many pockets as needed. For instance, in a four pair cable, the channel filler will have four pockets, in a 10 pair cable, the channel filler would have 10 pockets.

Referring to FIG. 7 there is shown a cable 60 having the same construction as the cable 50 except it has shield 61 wrapped around the core. The shield 61 may be any suitable shield such as an aluminum tape, BELDFOIL, DUOFOIL, or any suitable metal tape. The shield 61 is wrapped around the core and then the jacket 54 is extruded around the shield. In a known manner, a drain wire (not shown) can be inserted into the cable 60 if desired.

Referring to FIG. 8, there is shown a cable 65 using a drain wire 66. The cable 65 has the same construction as the cable 60 except in this embodiment, the drain wire 66 is helically wrapped around the lateral shield 61 for the dual purpose of being a drain wire and to hold the lateral shield 61 in place. The jacket 54 is then extruded over the shield 61 and drain wire 66.

Referring to FIG. 9, there is shown still another cable 70 having the same construction as the cable 60 except in this embodiment, there is a channel filler 71 constructed the same a channel filler 20 except channel filler 71 has a central longitudinally extending filler or strength member 72. This member 72 can be of any desired material and is generally a polyethylene rod.

The drain wire 66, is generally made with tinned copper, tinned aluminum, etc.

Referring to FIG. 10, there is shown a cable filler 75 with an alternative structure. The cable filler shown has four longitudinally extending open pockets 76. Each of the pockets 76 have a pair of spaced side walls 77 and 78 extending outwardly from the ends of an arcuate or convex bottom wall 79 towards the outer circumference 80 of the filler 75. The filler 75 has a central axis 81, a rod central section 82 and an outer circumference 80. The outer walls of the rod 82 being the pocket bottom wall 79. The pocket openings are formed by the channel filler outer circumference wall 80 and have an opening width 83. The opening width 83 is less than the diameter of the cable envelope that is to be placed in the pocket i.e. 43 (FIG. 4). As noted above.

the smallest width of the opening 83 is the cable envelope diameter minus a maximum allowable compression distance of said cable. Each pocket has a depth 84 which extends perpendicular through the center 85 of the pocket opening width 83 to the filler circumference 80. The depth 84 is equal to or greater than the diameter of the cable envelope i.e. 43 (FIG. 4). The width must be sufficiently wide so as not to crush the cable therein therefore, the cross-sectional area of the pocket 76 when measured to the circumference 81 is greater than the cross-sectional area of the cable envelope i.e. 43 (FIG. 4).

As noted above, with regard to our channel filler 20, the channel filler 75 will also have as many pockets as needed i.e. a 10 pair cable channel filler would have 10 pockets.

The longitudinally extending pockets of our channel fillers 20 and 75 may have their longitudinal axis 35 or the longitudinally extending center 85 extending parallel to their respective longitudinal axis 25, 81 of their respective fillers 20 and 75 or twisted there around as illustratively shown by FIGS 11 and 12.

Although I have described our preferred elongated channel filler as having four pockets, the channel filler may have more or less pockets and the pockets, as noted above, are preferably sized to the cables they are to hold. The pockets can hold different types of cables as mentioned above and it may have other alternative structures as referenced by but not limited to FIG 10.

It will, of course, be appreciated that the embodiments which have just been described have been given by way of illustration, and the invention is not limited to the precise embodiments described herein. Various changes and modifications may be effected by one skilled in the art at without departing
5 from the scope or spirit of the invention as defined in the appended claims.

WE CLAIM

1. A cable channel filler comprising:
a longitudinally extending channel filler body having a plurality of
spaced longitudinally extending open pockets;

5 said pockets being sized to hold a cable therein with said cable having
an envelope diameter,

each of said pockets having a channel opening extending from the
pocket, and

10 said channel opening having an opening width less than said envelope
diameter.

2. The channel filler of claim 1 wherein,
each of said pockets have a longitudinally extending axis extending
substantially parallel to each other, and

15 each of said pockets have a pocket diameter substantially equal to said
envelope diameter.

3. The channel filler of claim 2 wherein,
said opening width of each of said pockets is less than said envelope

diameter and equal to or greater than said envelope diameter minus a maximum allowable compression distance of said cable.

4. The channel filler of claim 3 wherein,
said opening width of each of said pockets is equal to said envelope
5 diameter minus a maximum allowable compression distance of said
cable.

5. The channel filler of claim 1, wherein,
said channel filler body is cylindrical,

said pockets are segmented tubes with channel openings extending
10 therefrom,

said channel filler body having a first pair of pockets diametrically
opposed to each other and a second pair of pockets diametrically
opposed to each other,

each of said first pair pockets having substantially the same cross-
15 sectional area, and

each of said second pair of pockets having substantially the same cross-
sectional area.

6. The channel filler of claim 5 wherein,
each of said pockets have a depth equal to or greater than said envelope
diameter of said cable to be placed in said pockets, and
said opening width of each of said pockets is less than said envelope
5 diameter and equal to or greater than said envelope diameter minus a
maximum allowable compression distance of said cable.

7. The channel filler of claim 6 wherein,
said channel filler body has a diameter of about 0.150 inches to about
0.350 inches,

10 each of said pockets having a diameter of about 0.060 inches to about
0.120 inches, and

each of said pockets having a depth of about 0.50 inches to about 0.150
inches.

8. A cable channel filler comprising:
15 a longitudinally extending channel filler having at least four spaced,
parallel longitudinally extending open pockets for separating at least
four twisted pair cables,

a cross-section of said channel filler having a first axis and a second

axis, said first axis being substantially perpendicular to said second axis,

a first pair of pockets being diametrically spaced from each other and being on the first axis,

5 a second pair of pockets being diametrically spaced from each other and being on the second axis,

each of said first pair of pockets having substantially the same cross-sectional area,

10 each of said second pair of pockets having substantially the same cross-sectional area,

each of said first pockets having a first pocket depth equal to or greater than a first cable envelope diameter of a first twisted pair cable to be place in said first pockets, and a first pocket cross sectional area equal to or greater than a first cable envelope cross sectional area,

15

the width of said first pocket opening is less than said first cable envelope diameter and equal to or greater than said first cable envelope diameter minus a maximum allowable compression

distance of said first cable,

each of said second pockets having a second pocket depth equal to or greater than a second cable envelope diameter of a second twisted pair cable to be place in said second pockets, and a second pocket cross

5 sectional area equal to or greater than a second cable envelope cross sectional area, and

the width of said second pocket opening is less than said second cable envelope diameter and equal to or greater than said second cable envelope diameter minus a maximum allowable compression distance

10 of said second cable.

9. A communication cable comprising:

a cable core surrounded by a jacket,

said cable core having

a longitudinally extending channel filler having at least four parallel

15 spaced, longitudinally extending open pockets for separating at least four twisted pair cables,

a cross-section of said channel filler having a first axis and a second axis,

said first axis being substantially perpendicular to said second axis,

20 a first pair of pockets being diametrically spaced from each other and being on the first axis,

a first twisted pair cable being in each of said first pair of pockets,
a second pair of pockets being diametrically spaced from each other and
being on the second axis,
a second twisted pair cable being in each of said
5 second pair of pockets,
each of said first pair of pockets having substantially the same cross-
sectional area,
each of said second pair of pockets having substantially the same cross-
sectional area,
10 each of said first pockets having a first pocket depth equal to or greater
than a first cable envelope diameter of said first twisted pair cable in said
first pockets, and a first pocket cross sectional area equal to or greater than
a first cable envelope cross sectional area,
the width of said first pocket opening is less than said first cable envelope
15 diameter and equal to or greater than said first cable envelope diameter
minus a maximum allowable compression distance of said first cable,
each of said second pockets having a second pocket depth equal to or
greater than a second cable envelope diameter of said second twisted pair
cable in said second pockets, and a second pocket sectional area equal to
20 or greater than a second cable envelope cross sectional area, and
the width of said second pocket opening is less than said second cable
envelope diameter and equal to or greater than said second cable envelope
diameter minus a maximum allowable compression distance of said
second cable.

10. A communication cable comprising:

a cable core surrounded by a jacket,

said cable core having

a longitudinally extending channel filler having a plurality of spaced

5 longitudinally extending open pockets,

a first cable in a plurality of said pockets,

said first cable having a cross sectional first cable envelope area and
envelope diameter,

each of said pockets containing said first cable,

10 each of said pockets having a channel opening having a width less than
said first cable envelope diameter,

and

each said pocket cross sectional area is equal to or greater than said
first cable envelope cross sectional area.

15 11. The communication cable of claim 10 wherein each of said pockets
longitudinally extend substantially parallel to each other, and the
opening width of each of said pockets is less than said envelope
diameter and equal to or greater than said envelope diameter minus a
maximum allowable compression distance of said cable in said pocket.

12. The communication cable of claim 11 wherein,
said channel filler body is cylindrical,
said channel filler body having a first pair of pockets diametrically
opposed to each other and a second pair of pockets diametrically
opposed to each other,
each of said first pair pockets having substantially the same cross-
sectional area, and
each of said second pair of pockets having substantially the same cross-
sectional area.

13. The communication cable of claim 12,
each of said pockets have a depth equal to or greater than said envelope
diameter of said cable to be placed in said pockets; and
said opening width is equal to said envelope diameter minus a
maximum allowable compression distance of said cable.

14. The communication cable of claim 13 wherein
said channel filler body has a diameter of about 0.150 inches to about
0.350 inches,
a plurality of said pockets having a diameter of about 0.060 inches to
about 0.120 inches, and
said pockets having a depth of about 0.050 inches to about
0.150 inches.

15. The communication cable of claim 8, wherein a shield surrounds said core and said jacket surrounds the shielded core.
16. The communication cable of claim 9, wherein a shield surrounds said core and said jacket surrounds the shielded core.
- 5 17. The communication cable of claim 11, wherein a shield surrounds said core and said jacket surrounds the shielded core.
18. The communication cable of claim 13, wherein a shield surrounds said core and said jacket surrounds the shielded core.
19. The communication cable of claim 14, wherein a shield surrounds said
10 core and said jacket surrounds the shielded core.

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FIG. 1

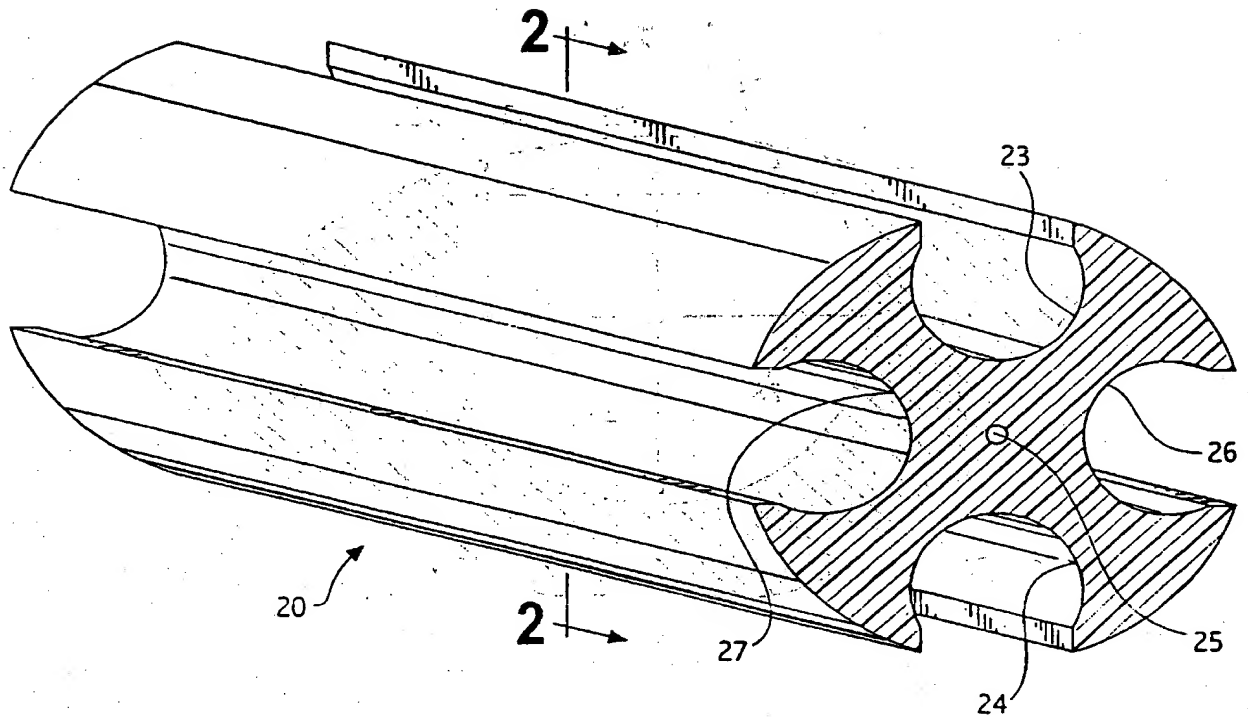
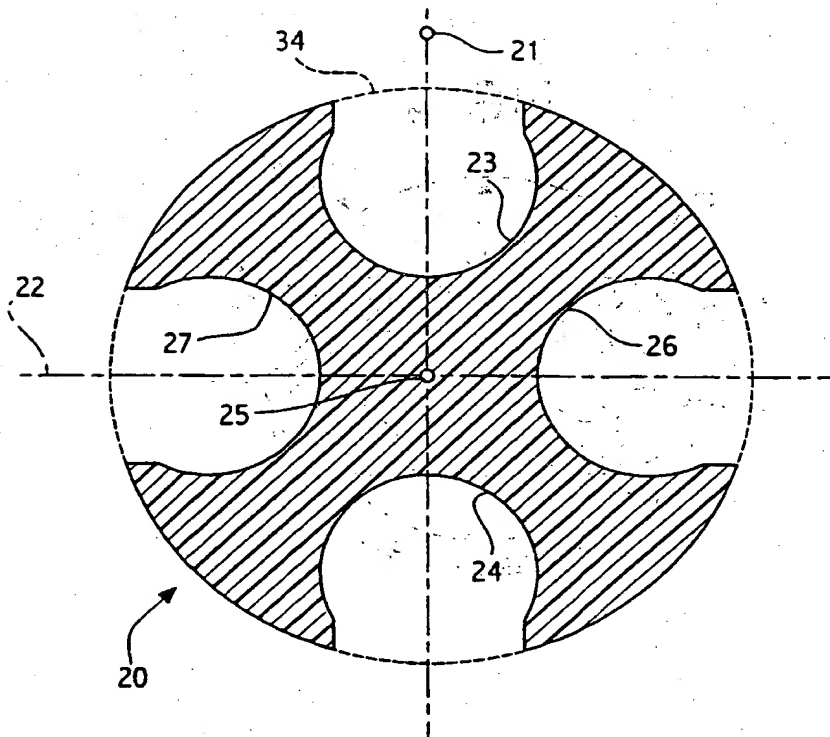


FIG. 2



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FIG. 3

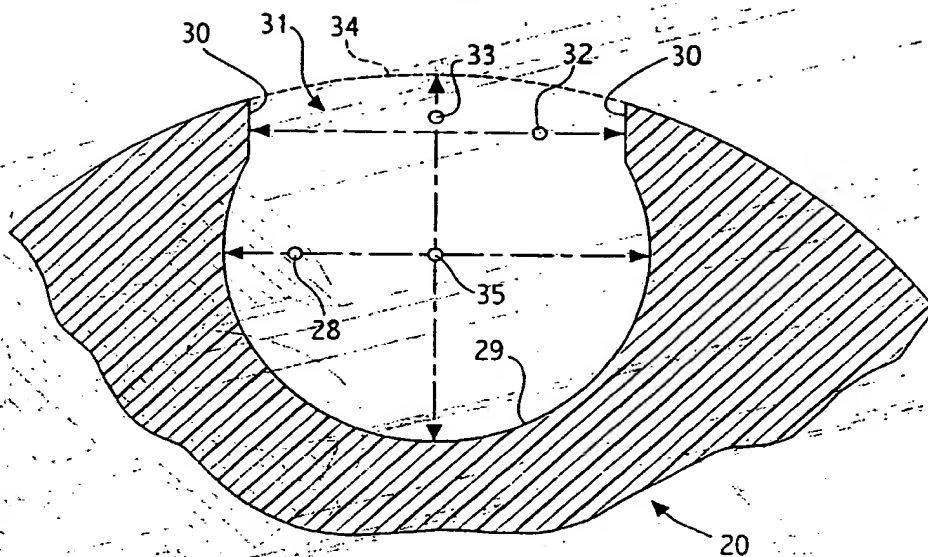
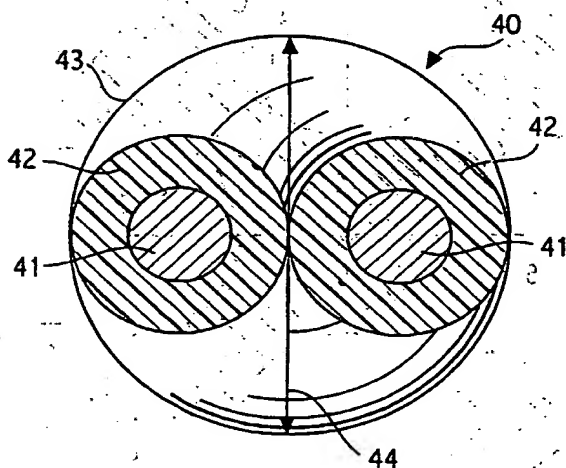


FIG. 4



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FIG. 5

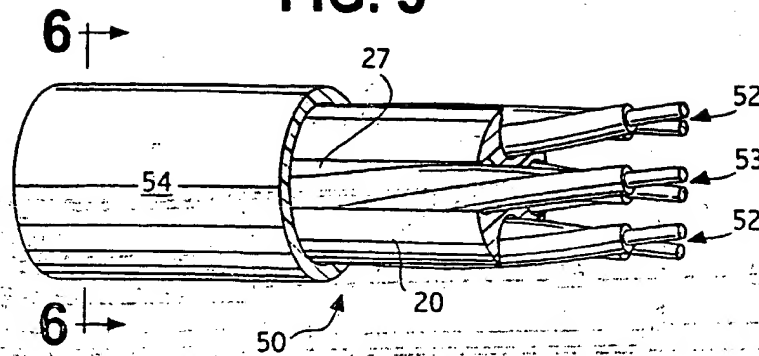


FIG. 6

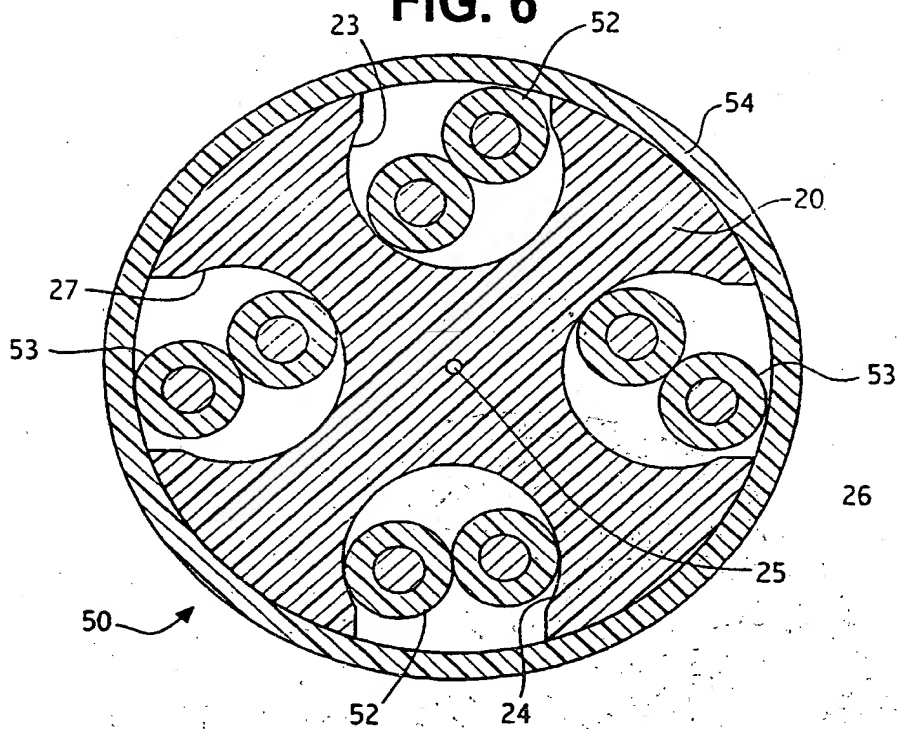
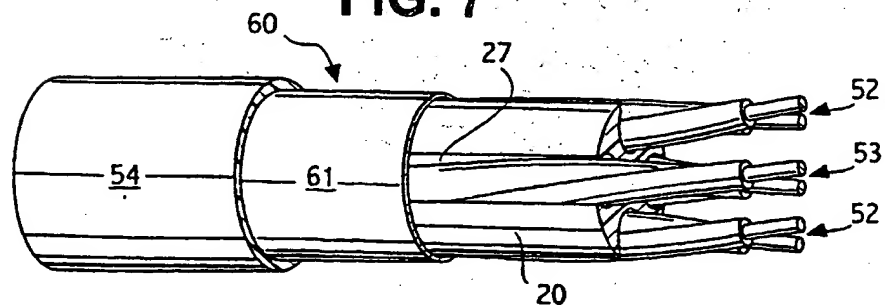
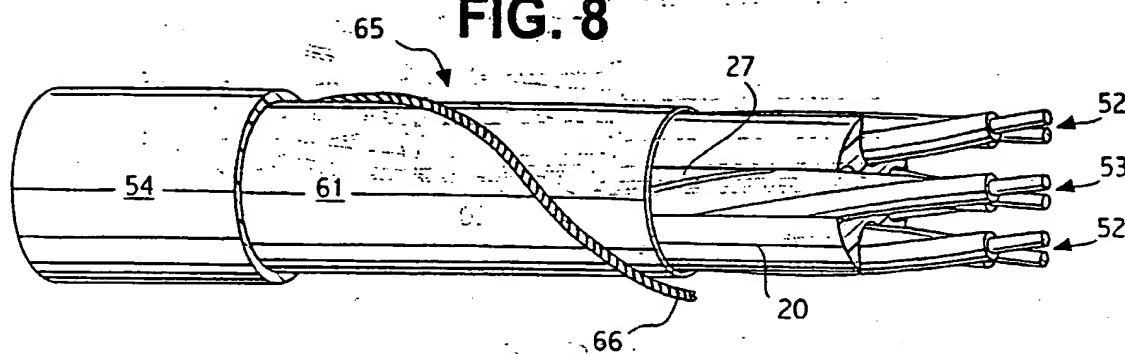
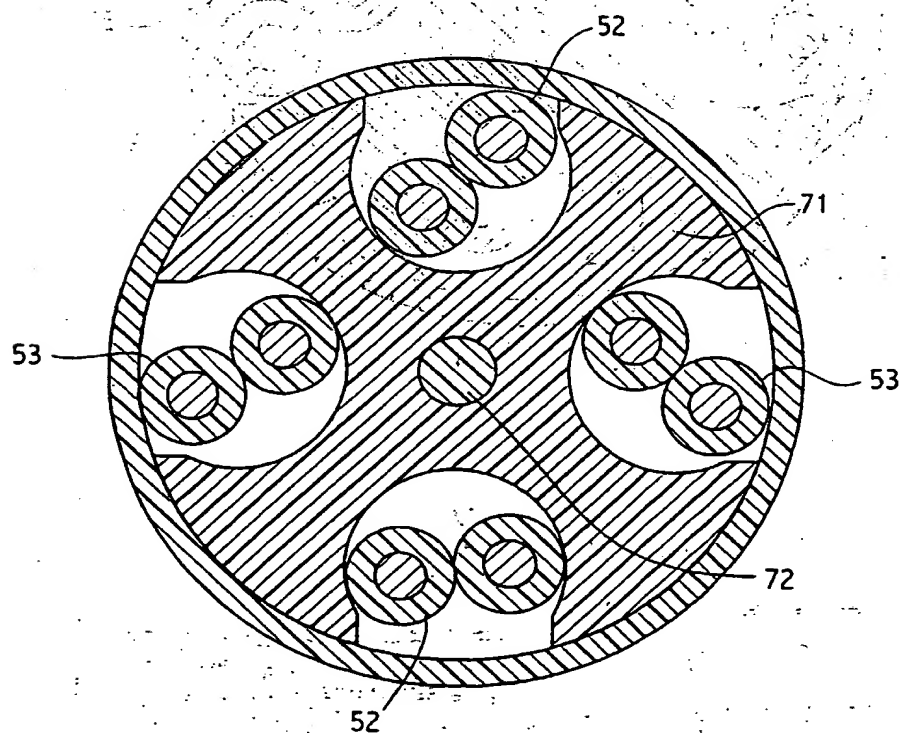


FIG. 7



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FIG. 8**FIG. 9**

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FIG. 10

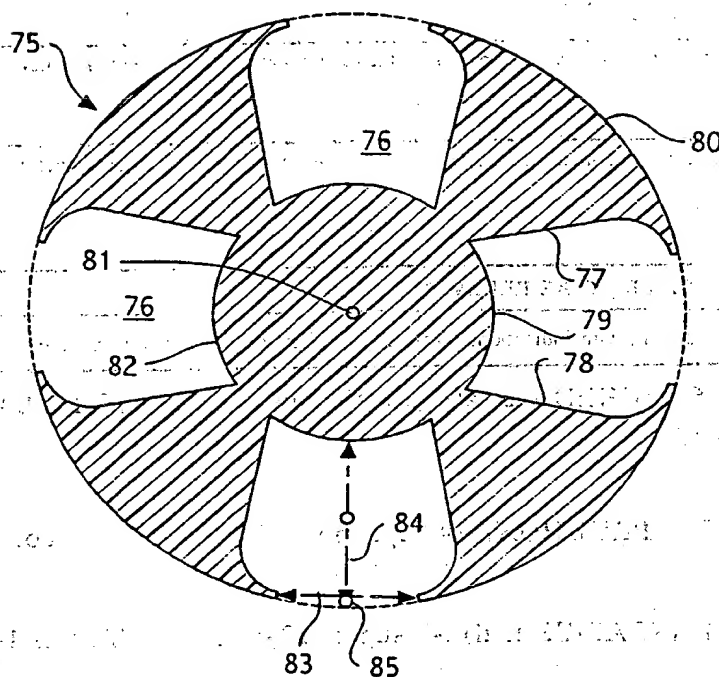


FIG. 11

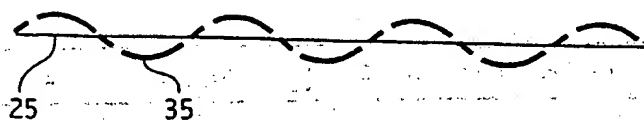
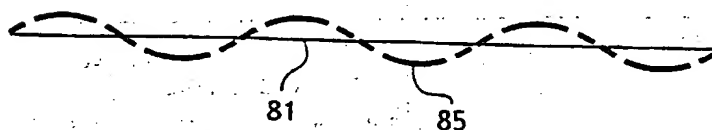


FIG. 12



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/42534

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H01B 7/00, 11/02

US CL : 174/110r, 113r, 113c, 113as, 120r

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 174/110r, 113r, 113c, 113as, 120r

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
noneElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
East APS Search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----	JP 404332406A (IKEDA et al) 19 November 1992 (19.11.92), abstract, Fig 1	1-8 ----
Y		9-19
Y	US 5,952,615 A (PRUDHON) 14 September 1999 (14.09.99), cols. 1-4, Fig 3	9-19
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☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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